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| Traveler Title | Cebaf Reworked Cryomodule 5-cell Cavity Dimensional Inspection | | | |
| Traveler Abstract | This traveler details the steps required to dimensionally and visually inspect a 5-cell C50 cavity. The steps consist of capturing dimensions using cmm and profilometer for receiving inspection, post pair disassembly, flange flatness correction, if needed. Also, the traveler captures steps for final inspection after RF tuning and final lapping. | | | |
| Traveler ID | C50R-CPR-INSP-CAV | | | |
| Traveler Revision | R3 | | | |
| Traveler Author | A. DeKerlegand | | | |
| Traveler Date | 26-Apr-2021 | | | |
| NCR Informative Emails | Georged | | | |
| NCR Dispositioners | macha,forehand,kdavis | | | |
| D3 Emails | macha,forehand,kdavis | | | |
| Approval Names | A. DeKerlegand | S. Williams | K. Macha |  |
| Approval Signatures |  |  |  |  |
| Approval Dates |  |  |  |  |
| Approval Title | Author | Reviewer | Project Manager |  |

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| References | List and Hyperlink all documents related to this traveler. This includes, but is not limited to: safety (THAs, SOPs, etc), drawings, procedures, and facility related documents. | | | |
| Interatom as built drawing  [11116-D-0001](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-209494/11116-0001%20REV%20B%201-2.pdf) |  |  |  |  |
| Original 5-cell cavity |  |  |  |  |

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| Revision Note |  |
| R1 | Initial release of traveler |
| R2 | Removed initial surface finish. BC 12/14/16 |
| R3 | Flange thickness added to dimensional inspection in traveler. Notes added for surface finish, measured in microinch (u inch). Initial visual and surface finish added. File upload boxes added. AD 4/26/21 |
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| Step No. | Instructions | Data Input |
| 1 | **Cavity serial number**. Select from drop down box the C50 cavity serial number | [[CAVSN]] <<CAVSN>> |
| 2 | **Initial visual inspection**.Visually inspect the cavity (internal and external). Record any damage in the comment box. Any stains, dents, foreign material, and/or scratches thru indium seal path should be noted. Are flanges acceptable? | [[VisualInspUser1]] <<SRF>>  [[VisualInspDate1]] <<TIMESTAMP>>  [[VisualInspComment1]] <<COMMENT>>  [[VisualOKYesNo1]] <<YESNO>>  [[VisualFiles1]] <<FILEUPLOAD>> |

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| Step No. | Instructions | | | | Data Input | |
| 3 | **Initial surface finish check (RA).** Measure the surface finish of the cavity flanges listed below using the Mitutoyo Profilometer. Check the four corners of flange outside of indium seal path and enter averaged value in measured value box below. **NOTE** - Beam tube flanges are visual inspection only.  **Units - Measured in microinch ( u in) for roughness avg (RA)** | | | | [[SurfaceFinishUser1]] <<SRF>>  [[SurfaceFinishDate1]] <<TIMESTAMP>>  [[SurfaceFinishComment1]] <<COMMENT>>  [[SurfaceFinishFiles1]] <<FILEUPLOAD>> | |
| **Drawing Number** | | **Description** | **Drawing Value** | **Has Flange had BCP ?** | **Measured Value** | **Within Tolerance** |
| 11116-D-0001 | | FPC flange | 32 microinch | [[BCP6]] <<YESNO>> | [[MeasValue1]] <<FLOAT>> | [[Tolerance1]] <<YESNO>> |
| 11116-D-0001 | | HOM flange (Field Probe) | 32 microinch | [[BCP7]] <<YESNO>> | [[MeasValue2]] <<FLOAT>> | [[Tolerance2]] <<YESNO>> |
| 11116-D-0001 | | HOM flange (Non-Field Probe) | 32 microinch | [[BCP8]] <<YESNO>> | [[MeasValue3]] <<FLOAT>> | [[Tolerance3]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (FPC) | 32 microinch | [[BCP9]] <<YESNO>> | Visual only | n/a |
| 11116-D-0001 | | Beam tube flange (Probe) | 32 microinch | [[BCP10]] <<YESNO>> | Visual only | n/a |

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| Step No. | Instructions | | | Data Input | |
| 4 | **“As found” inspection**. Dimensionally inspect cavity using Coordinate Measuring Machine. Units - Inch  **If any of the cavity flanges have flatness measurements that are over 0.002", those flanges will need to be reworked.**  **If over 0.008" use backing flanges with shim to improve flatness then deliver to lapping for rough lapping if flatness is between .003” - .007***”* | | | [[CMMUser1]] <<SRF>>  [[CMMDate1]] <<TIMESTAMP>>  [[CMMComment1]] <<COMMENT>>  [[CMMFiles1]] <<FILEUPLOAD>> | |
| **Drawing Number** | | **Description** | **Drawing Value / TOL.** | **Measured Value** | **Within Tolerance** |
| 11116-D-0001 | | Cavity overall length | 28.319 inch | [[MeasValue4]] <<FLOAT>> | [[Tolerance4]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange height | 2.996 inch | [[MeasValue5]] <<FLOAT>> | [[Tolerance5]] <<YESNO>> |
| 11116-D-0001 | | Fpc to beam tube flange distance | 1.817 inch | [[MeasValue6]] <<FLOAT>> | [[Tolerance6]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange parallelism | 0.010 inch | [[MeasValue7]] <<FLOAT>> | [[Tolerance7]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange perpendicularity | 0.020 inch | [[MeasValue8]] <<FLOAT>> | [[Tolerance8]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Fpc end perp. | 0.010 inch | [[MeasValue9]] <<FLOAT>> | [[Tolerance9]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Probe end perp. | 0.010 inch | [[MeasValue10]] <<FLOAT>> | [[Tolerance10]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange flatness | .002 inch | [[MeasValue11]] <<FLOAT>> | [[Tolerance11]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (FPC) flatness | .002 inch | [[MeasValue12]] <<FLOAT>> | [[Tolerance12]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Probe) flatness | .002 inch | [[MeasValue13]] <<FLOAT>> | [[Tolerance13]] <<YESNO>> |
| 11116-D-0001 | | HOM (Field Probe) flange flatness | .002 inch | [[MeasValue14]] <<FLOAT>> | [[Tolerance14]] <<YESNO>> |
| 11116-D-0001 | | HOM (Non-Field Probe) flange flatness | .002 inch | [[MeasValue15]] <<FLOAT>> | [[Tolerance15]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange thickness | .500 inch MIN | [[MeasValue16]] <<FLOAT>> | [[Tolerance16]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Fpc) thickness | .325 inch MIN | [[MeasValue17]] <<FLOAT>> | [[Tolerance17]] <<YESNO>> |
| 11116-D-0001 | | Hom (Non-Field Probe) flange thickness | .325 inch MIN | [[MeasValue18]] <<FLOAT>> | [[Tolerance18]] <<YESNO>> |
| 11116-D-0001 | | Hom (Fp) flange thickness | .325 inchMIN | [[MeasValue19]] <<FLOAT>> | [[Tolerance19]] <<YESNO>> |
| 11116-D-0001 | | Beam tube (Probe end) flange thickness | .325 inch MIN | [[MeasValue20]] <<FLOAT>> | [[Tolerance20]] <<YESNO>> |

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| Step No. | Instructions | | | Data Input | |
| 5 | **Re-Inspection after rough lapping to verify flange flatness correction.**  **If any of the cavity flanges have flatness measurements that are over 0.002", those flanges will need to be reworked.**  **If over 0.008" use backing flanges with shim to improve flatness then deliver to lapping for rough lapping if flatness is between .003” - .007***”* | | | [[CMMUser2]] <<SRF>>  [[CMMDate2]] <<TIMESTAMP>>  [[CMMComment2]] <<COMMENT>>  [[CMMFiles2]] <<FILEUPLOAD>> | |
| **Drawing Number** | | **Description** | **Drawing Value / TOL.** | **Measured Value** | **Within Tolerance** |
| 11116-D-0001 | | Cavity overall length | 28.319 inch | [[MeasValue21]] <<FLOAT>> | [[Tolerance21]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange height | 2.996 inch | [[MeasValue22]] <<FLOAT>> | [[Tolerance22]] <<YESNO>> |
| 11116-D-0001 | | Fpc to beam tube flange distance | 1.817 inch | [[MeasValue23]] <<FLOAT>> | [[Tolerance23]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange parallelism | 0.010 inch | [[MeasValue24]] <<FLOAT>> | [[Tolerance24]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange perpendicularity | 0.020 inch | [[MeasValue25]] <<FLOAT>> | [[Tolerance25]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Fpc end perp. | 0.010 inch | [[MeasValue26]] <<FLOAT>> | [[Tolerance26]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Probe end perp. | 0.010 inch | [[MeasValue27]] <<FLOAT>> | [[Tolerance27]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange flatness | .002 inch | [[MeasValue28]] <<FLOAT>> | [[Tolerance28]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (FPC) flatness | .002 inch | [[MeasValue29]] <<FLOAT>> | [[Tolerance29]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Probe) flatness | .002 inch | [[MeasValue30]] <<FLOAT>> | [[Tolerance30]] <<YESNO>> |
| 11116-D-0001 | | HOM (Field Probe) flange flatness | .002 inch | [[MeasValue31]] <<FLOAT>> | [[Tolerance31]] <<YESNO>> |
| 11116-D-0001 | | HOM (Non-Field Probe) flange flatness | .002 inch | [[MeasValue32]] <<FLOAT>> | [[Tolerance32]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange thickness | .500 inch MIN | [[MeasValue33]] <<FLOAT>> | [[Tolerance33]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Fpc) thickness | .325 inch MIN | [[MeasValue34]] <<FLOAT>> | [[Tolerance34]] <<YESNO>> |
| 11116-D-0001 | | Hom (Non-Field Probe) flange thickness | .325 inch MIN | [[MeasValue35]] <<FLOAT>> | [[Tolerance35]] <<YESNO>> |
| 11116-D-0001 | | Hom (Fp) flange thickness | .325 inchMIN | [[MeasValue36]] <<FLOAT>> | [[Tolerance36]] <<YESNO>> |
| 11116-D-0001 | | Beam tube (Probe end) flange thickness | .325 inch MIN | [[MeasValue37]] <<FLOAT>> | [[Tolerance37]] <<YESNO>> |

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| Step No. | Instructions | | | Data Input | |
| 6 | **Post tuning inspection.**  **Note – bending required if dimensions below are out of tolerance :**  -Fpc parallelism  -Fpc perpendicularity  -Beam tube Fpc end perp.  -Beam tube Probe end perp.  Upon completion of bending and dimensions are within tolerance return cavity back to tuning room for RF inspection.  Bending required? Select yes or no.  How many cmm/tuning cycles? Please provide number in value box. | | | [[CMMUser3]] <<SRF>>  [[CMMDate3]] <<TIMESTAMP>>  [[CMMComment3]] <<COMMENT>>  [[CMMFiles3]] <<FILEUPLOAD>>  [[BendingRequired1]] <<YESNO>>  [[Number\_of\_tune\_bend\_cycles1]] <<INTEGER>> | |
| **Drawing Number** | | **Description** | **Drawing Value / TOL.** | **Measured Value** | **Within Tolerance** |
| 11116-D-0001 | | Cavity overall length | 28.319 inch | [[MeasValue38]] <<FLOAT>> | [[Tolerance38]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange height | 2.996 inch | [[MeasValue39]] <<FLOAT>> | [[Tolerance39]] <<YESNO>> |
| 11116-D-0001 | | Fpc to beam tube flange distance | 1.817 inch | [[MeasValue40]] <<FLOAT>> | [[Tolerance40]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange parallelism | 0.010 inch | [[MeasValue41]] <<FLOAT>> | [[Tolerance41]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange perpendicularity | 0.020 inch | [[MeasValue42]] <<FLOAT>> | [[Tolerance42]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Fpc end perp. | 0.010 inch | [[MeasValue43]] <<FLOAT>> | [[Tolerance43]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Probe end perp. | 0.010 inch | [[MeasValue44]] <<FLOAT>> | [[Tolerance44]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange flatness | .002 inch | [[MeasValue45]] <<FLOAT>> | [[Tolerance45]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (FPC) flatness | .002 inch | [[MeasValue46]] <<FLOAT>> | [[Tolerance46]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Probe) flatness | .002 inch | [[MeasValue47]] <<FLOAT>> | [[Tolerance47]] <<YESNO>> |
| 11116-D-0001 | | HOM (Field Probe) flange flatness | .002 inch | [[MeasValue48]] <<FLOAT>> | [[Tolerance48]] <<YESNO>> |
| 11116-D-0001 | | HOM (Non-Field Probe) flange flatness | .002 inch | [[MeasValue49]] <<FLOAT>> | [[Tolerance49]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange thickness | .500 inch MIN | [[MeasValue50]] <<FLOAT>> | [[Tolerance50]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Fpc) thickness | .325 inch MIN | [[MeasValue51]] <<FLOAT>> | [[Tolerance51]] <<YESNO>> |
| 11116-D-0001 | | Hom (Non-Field Probe) flange thickness | .325 inch MIN | [[MeasValue52]] <<FLOAT>> | [[Tolerance52]] <<YESNO>> |
| 11116-D-0001 | | Hom (Fp) flange thickness | .325 inchMIN | [[MeasValue53]] <<FLOAT>> | [[Tolerance53]] <<YESNO>> |
| 11116-D-0001 | | Beam tube (Probe end) flange thickness | .325 inch MIN | [[MeasValue54]] <<FLOAT>> | [[Tolerance54]] <<YESNO>> |

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| Step No. | Instructions | | | Data Input | |
| 7 | **Final CMM inspection (after final lapping and chemistry).**  **Note – bending required if dimensions shown below are out of tol. :**  -Fpc parallelism  -Fpc perpendicularity  -Beam tube Fpc end perp.  -Beam tube Probe end perp.  Bending required? Select yes or no.  How many cmm/tuning cycles? Please provide number in value box. | | | [[CMMUser4]] <<SRF>>  [[CMMDate4]] <<TIMESTAMP>>  [[CMMComment4]] <<COMMENT>>  [[CMMFiles4]] <<FILEUPLOAD>>  [[BendingRequired2]] <<YESNO>>  [[Number\_of\_tune\_bend\_cycles2]] <<INTEGER>> | |
| **Drawing Number** | | **Description** | **Drawing Value / TOL.** | **Measured Value** | **Within Tolerance** |
| 11116-D-0001 | | Cavity overall length | 28.319 inch | [[MeasValue55]] <<FLOAT>> | [[Tolerance55]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange height | 2.996 inch | [[MeasValue56]] <<FLOAT>> | [[Tolerance56]] <<YESNO>> |
| 11116-D-0001 | | Fpc to beam tube flange distance | 1.817 inch | [[MeasValue57]] <<FLOAT>> | [[Tolerance57]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange parallelism | 0.010 inch | [[MeasValue58]] <<FLOAT>> | [[Tolerance58]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange perpendicularity | 0.020 inch | [[MeasValue59]] <<FLOAT>> | [[Tolerance59]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Fpc end perp. | 0.010 inch | [[MeasValue60]] <<FLOAT>> | [[Tolerance60]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange Probe end perp. | 0.010 inch | [[MeasValue61]] <<FLOAT>> | [[Tolerance61]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange flatness | .002 inch | [[MeasValue62]] <<FLOAT>> | [[Tolerance62]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (FPC) flatness | .002 inch | [[MeasValue63]] <<FLOAT>> | [[Tolerance63]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Probe) flatness | .002 inch | [[MeasValue64]] <<FLOAT>> | [[Tolerance64]] <<YESNO>> |
| 11116-D-0001 | | HOM (Field Probe) flange flatness | .002 inch | [[MeasValue65]] <<FLOAT>> | [[Tolerance65]] <<YESNO>> |
| 11116-D-0001 | | HOM (Non-Field Probe) flange flatness | .002 inch | [[MeasValue66]] <<FLOAT>> | [[Tolerance66]] <<YESNO>> |
| 11116-D-0001 | | Fpc flange thickness | .500 inch MIN | [[MeasValue67]] <<FLOAT>> | [[Tolerance67]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (Fpc) thickness | .325 inch MIN | [[MeasValue68]] <<FLOAT>> | [[Tolerance68]] <<YESNO>> |
| 11116-D-0001 | | Hom (Non-Field Probe) flange thickness | .325 inch MIN | [[MeasValue69]] <<FLOAT>> | [[Tolerance69]] <<YESNO>> |
| 11116-D-0001 | | Hom (Fp) flange thickness | .325 inchMIN | [[MeasValue70]] <<FLOAT>> | [[Tolerance70]] <<YESNO>> |
| 11116-D-0001 | | Beam tube (Probe end) flange thickness | .325 inch MIN | [[MeasValue71]] <<FLOAT>> | [[Tolerance71]] <<YESNO>> |

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| Step No. | Instructions | Data Input |
| 8 | **Final visual inspection**.Visually inspect the cavity (internal and external). Record any damage in the comment box. Any stains, dents, foreign material, and/or scratches thru indium seal path should be noted. Are flanges acceptable? | [[VisualInspUser2]] <<SRF>>  [[VisualInspDate2]] <<TIMESTAMP>>  [[VisualInspComment2]] <<COMMENT>>  [[VisualOKYesNo2]] <<YESNO>>  [[VisualFiles2]] <<FILEUPLOAD>> |

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| Step No. | Instructions | | | | Data Input | |
| 9 | **Final surface finish check (RA).** Measure the surface finish of the cavity flanges listed below using the Mitutoyo Profilometer. Check the four corners of flange outside of indium seal path and enter averaged value in measured value box below.  **NOTE** - Beam tube flanges are visual inspection only.    **Units - Measured in microinch ( u in). for roughness avg (RA).** | | | | [[SurfaceFinishUser2]] <<SRF>>  [[SurfaceFinishDate2]] <<TIMESTAMP>>  [[SurfaceFinishComment2]] <<COMMENT>>  [[SurfaceFinishFiles2]] <<FILEUPLOAD>> | |
| **Drawing Number** | | **Description** | **Drawing Value** | **Has Flange had BCP ?** | **Measured Value** | **Within Tolerance** |
| 11116-D-0001 | | FPC flange | 32 microinch | [[BCP6]] <<YESNO>> | [[MeasValue72]] <<FLOAT>> | [[Tolerance72]] <<YESNO>> |
| 11116-D-0001 | | HOM flange (Field Probe) | 32 microinch | [[BCP7]] <<YESNO>> | [[MeasValue73]] <<FLOAT>> | [[Tolerance73]] <<YESNO>> |
| 11116-D-0001 | | HOM flange (Non-Field Probe) | 32 microinch | [[BCP8]] <<YESNO>> | [[MeasValue74]] <<FLOAT>> | [[Tolerance74]] <<YESNO>> |
| 11116-D-0001 | | Beam tube flange (FPC) | 32 microinch | [[BCP9]] <<YESNO>> | Visual only | n/a |
| 11116-D-0001 | | Beam tube flange (Probe) | 32 microinch | [[BCP10]] <<YESNO>> | Visual only | n/a |